

## CONTRIBUTIONS TO THE CLIMATOLOGY OF BRITISH NORTH AMERICA.

### SOME OF THE OBJECTS TO BE SOUGHT AND MEANS TO BE EMPLOYED IN PROSECUTING CLIMATOLOGICAL ENQUIRIES.

*By G. T. KINGSTON, Director of the Magnetic Observatory, Toronto.*

A description of the climate of a country comprises the following particulars :—

- I. In the first place and explicitly for several stations, and secondly but implicitly for all stations, the normal mean annual values of the meteorological elements derived from a series of years, including in the term element the temperature of the air, the barometric pressure, and all numbers that take part in defining the condition of a climate at any instant, as well as the numbers which express the frequency and intensity of occasional phenomena, such as rain, snow, thunder, &c., &c.
- II. The secular or progressive changes from year to year, which in some cases go on continually in one direction either of constant increase or constant decrease; the periodic variations, such as the annual and diurnal variations, which complete their cycles in a year and day respectively, and which include implicitly the normal or most probable values of the element at any instant; and the secular variations (where such exist) which occupy several years in their period.
- III. The *variability* of the climate, or the *extent* of the abnormal deviations of single observed values, as well as of daily, monthly, and annual means in single years, from the corresponding normals and normal means founded on the observations of several years; and also the *rapidity* with which irregular oscillations occur.
- IV. The laws which express the mutual dependence of the abnormal conditions of the several elements.
- V. The dependence of the climate in its normal condition on circumstances affecting the country generally, as well as on special local regularities, such as proximity to water, quality of soil, extent of land cleared, &c. This includes the consideration of any effect which a change of local circumstances produces on the meteorological normals and on their periodic variations.
- VI. The laws which concern the geographical space occupied at any instant by an atmospheric disturbance, the extent of country affected during the whole of a disturbed period, and the direction and rate of its movement.

While the numerical quantities to which reference is made in paragraphs I to IV can be stated explicitly, in the first instance, for definite localities more or less numerous, the most probable values of the corresponding numbers for all other points through the country are to be inferred, and the results expressed either by tables, or graphically, by isometric lines.

A description of the climate of a place or country would be incomplete, unless a comparison were also made between the normal values of its climatic elements with their variations, and the corresponding numbers for similarly situated countries in other parts of the world.

The foregoing remarks relate to climate and the causes which affect climate, and belong properly to Meteorology. There are other questions of great practical interest, which though not purely meteorological are intimately connected with meteorology. Of this kind are those which concern the general adaptation of the climate to animal and vegetable life and industrial occupations, as well as those which relate to the special influence exerted on them by abnormal circumstances in the climate.

It will be necessary now to dwell more in detail on the various points named above, employing in illustration some numerical results furnished chiefly from the Toronto observations.

The determination of normal means, and normals for days and hours is the business of meteorologist which ranks first in order of time.

Normals constitute the proper standards for comparing different stations with respect to the same element, and they also serve, at the same station, as standards for estimating the character of a particular day and hour relative to the element under consideration, and for computing the general effect produced on this element by any known cause, as well as the effect which is produced by an abnormal condition of the element,